

A Transactional Systems Model of Autism Services

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There has been an escalation in the number of children identified with autism spectrum disorders in recent years. To increase the likelihood that treatments for these children are effective, interventions should be derived from sound theory and research evidence. Absent this supportive foundation, intervention programs could be inconsequential if not harmful. Although atypical, the development of children with autism should be considered initially from the perspective of the same variables that affect the development of typical children. In addition, the developmental deviations that characterize autism must be considered when developing intervention programs. Behavioral systems models describe both typical and atypical development and emphasize dynamic multidirectional person–environment transactions. The environment is viewed as having multiple levels, from the individuals with autism themselves, to larger societal and cultural levels. Behavioral systems models of human development can be generalized to a transactional systems model of services for children with autism. This model is the foundational theoretical position of the Southern Illinois University Center for Autism Spectrum Disorders. The center's programs are described to illustrate the application of the model to multiple levels of the social ecology.

Key words: autism, autism services, transactional ecological systems, transactional systems, development

Autism disorder is characterized by qualitative impairments in communication and social interaction, as well as restricted, repetitive patterns of interests and behavior (American Psychiatric Association, 2000). Autism, along with Asperger disorder and pervasive developmental disorders (not otherwise specified), have been termed *autism spectrum disorders* because affected individuals, to varying degrees, share common characteristics along a continuum. The Autism Society of America (<http://www.autism-society.org/site/PageServer?pagename=FactsStats>) has disseminated the following facts from vari-

ous governmental and nongovernmental sources. Approximately 1 in 150 children born today will be diagnosed on the spectrum, with 1 to 1.5 million Americans having the disorder. During the 1990s there was a growth of 172% in the disorder compared to a 13% increase in the United States population. To support the increased identification of children with autism, it is estimated that the projected annual cost in 10 years will be \$200 to \$400 billion.

The increase in the number of children identified with autism has been attributed to several factors, which at this time are all speculative. One possibility is that the number of cases of autism have varied across epidemiological studies because their research methodology differed (e.g., whether sampling was based on people actually diagnosed vs. total population). Another factor that might account for the increase in the cases of autism is the change in the construct published in the various editions of the *Diagnostic and Statistical Manual*

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of *Mental Disorders (DSM)* of the American Psychiatric Association. The representation of the disorder has evolved over the years to recognize today that there is a range of clinical manifestations, and people with autism and related characteristics are a heterogeneous group. For example, the third edition of the *DSM* (1987) increased the number of possible symptoms with which a child could be diagnosed with autism. Subsequently, the fourth edition (1994) incorporated three new pervasive developmental disorders (Rett disorder, childhood disintegrative disorder, and Asperger disorder), along with autism disorder and pervasive developmental disorder (not otherwise specified). Thus, the broadening of both the autism spectrum and pervasive developmental disorders classes might account for the increase in the number of children diagnosed.

Along with this broadening of the construct, there has been a growing recognition that autism can be comorbid and diagnosed with other developmental, genetic, medical, and psychiatric conditions. In addition, there has been greater societal awareness of the disorder in recent years, by parents, medical personnel, and the public. This recognition might have led to referral and diagnosis of children who might not have been diagnosed previously. Still another factor that might account for more cases of autism is the availability of new assessment instruments. In the past, the diagnosis of autism relied principally on clinical observation of the child's behavior in relation to the *DSM* criteria. Recently, however, new gold-standard assessment instruments have become available to supplement clinical observation: Autism Diagnostic Interview—Revised (ADI-R; LeCouteur, Lord, & Rutter, 2003), and the Autism Diagnostic Observation Schedule (ADOS; Lord et al., 2000). The various factors cited might account for the growing number of children identified with autism without a true

increase in the incidence of the disorder itself. Nevertheless, these factors remain speculative, and a true increase in the incidence of autism cannot be ruled out.

As a consequence of the increase in the number of children identified with an autism spectrum disorder, the number of individuals presenting themselves for services has escalated in recent years. Autism was included in the Individuals with Disabilities Education Act (IDEA; 1990) as one of the categories of disabilities eligible for federal funding. Eligibility under the act entitles children to a free and appropriate public education with an individual education plan. This educational entitlement also might be a factor accounting for the increase in the number of children with autism. Nationally, the number of children with autism served under IDEA has increased in recent years (Yell & Katsiyannis, 2003). Under IDEA, states have the authority to determine their own classification language. States such as California, Illinois, and Florida have seen an increase in the number of children with autism spectrum disorders enrolled in their educational systems (Feinberg & Vacca, 2000). Perhaps this increase in enrollment is a result of the greater number of children identified, the statutory education entitlement, and availability of federal funding.

To help meet the growing demand for services, individual treatments as well as more comprehensive intervention programs for individuals with autism have been developed from various conceptual models, including behavioral, developmental, educational, interpersonal relationship, physiological-biological-neurological, and others (Simpson et al., 2005). Different theories offer different conceptual understandings of autism and its symptoms, and proponents of a particular theory may selectively direct their clinical attention and tailor their interventions to symptoms favored by that theory. Some-

times the conceptual or theoretical underpinnings of either individual treatments or more comprehensive programs for individuals with autism are not explicitly and comprehensively understood or presented. Nevertheless, a program of services should be derived from empirical research and a coherent set of theories involving typical human development, developmental psycho- and neuropathology, and behavior change, as well as theories that explain specific risk factors and impairments that occur for persons with autism (Mash & Dozois, 2003).

The development of either autism-specific treatments or a more comprehensive autism program without sound theoretical and evidence-based guidance can lead to inconsequential if not harmful interventions. Fad treatments that lack both theoretical and empirical merit have proliferated in autism services (Green, 1996). Nevertheless, these treatments are endorsed by their proponents and are part of the intervention menu offered by some autism service providers. It is important, therefore, that a program of autism services be based on and accurately reflect its underlying concepts and constructs, and that there be empirical support from program outcomes to validate the underlying theories and program conceptualizations. The purpose of this article is to describe transactional approaches to human development and their implications for autism disorder and autism service programs, using the Southern Illinois University Center for Autism Spectrum Disorders (CASD) program as an exemplar.

Developmental Systems Models of Human Development and Implications for Autism

The foundational theoretical position of the CASD program rests on models of typical human development, and their implications for de-

velopmental disorders, that have evolved over the past several decades. The models have been labeled variously as behavioral analytic (Bijou & Baer, 1978; Schlinger, 1995), bioecological (Bronfenbrenner, 1977), contextual (Lerner & Kauffman, 1985), structural-behavioral (Horowitz, 1987), transactional (Sameroff, 1983), and behavioral systems (Novak, 1996; Novak & Peláez, 2004). All these models share the view that human development progresses by multiple simultaneous and continuous transactions between the organism and environment, thereby causing both to change reciprocally over time. The biological organism both affects and is affected by the environment. The reorganized transformations reorganize once again and continuously transform themselves by repeated dynamic interactions. The effect of the environment on human development will depend on the characteristics of the person affected by the environment at a given time. Likewise, the effect of the person on the environment will depend on the characteristics of the environment impinged on at a given time.

According to developmental systems models, outcomes for individuals are contextually determined. The context not only changes dynamically for the same individual but also differs at the same time for different individuals. The trajectory of development is nonlinear, with emergent reorganized patterns that occur. There may be phase shifts or sudden changes in the rate or form of development. With respect to the models of development cited, environment refers to experiential interactions and not the environment without these interactive experiences.

There are multiple organismic and environmental sources of influence, and their interactions can be multidirectional. Various individuals could have a similar developmental endpoint (e.g., autism) but may ontologically arrive through different path-

ways of combinations of multiple interacting organic and environmental events and processes. This phenomenon has been termed *equifinality* (Cicchetti & Rogosch, 1996; Holmbeck, Greenley, & Franks, 2003; Novak & Peláez, 2004). It also is the case that the same developmental events could produce different adjustment outcomes or *multifinality* (Holmbeck et al.). For example, children in the same autism intervention program with similar instructional goals, instructional techniques, and intensity of instruction could have different developmental trajectories and outcomes over time. Another developmental psychopathological phenomenon, *heterotypic continuity*, is a construct that denotes differences over time in the manifestation of the same pathological process (Holmbeck et al.). The communication and social skills, as well as restricted behavior, of a child with autism may show temporal qualitative and quantitative differences. Although the individual may still meet the diagnostic criteria for autism over the life span, there might be relative temporal improvement or deterioration in the core behavioral characteristics.

Although the developmental systems models share these core conceptualizations, each model has its own interpretations and emphases. The behavior-analytic model of human development has evolved both in description and explanation, and, perhaps, finds its fullest expression today in the behavioral systems model (Novak, 1996; Novak & Peláez, 2004). The core tenet of this model is that human development is the progressive or cumulative product of a person's continuous dynamic interactions with the environment. The person with a genetic-constitutional makeup, history of interactions with the environment, and current physiological conditions interacts with the current environmental contingencies and contextual variables dynamically over

time. Behavior at any point is a result of coalescent organization of these multiple organismic and environmental factors. Although stated in the context of verbal behavior a half century ago, Skinner (1957) acknowledged the transactional nature of human behavior when he stated, "Men act upon the world, and change it, and are changed in turn by the consequences of their action" (p. 1). A behavioral systems model serves as a compatible framework for considering autism as a product of the coalescence of organism-environment transactions over time. Temporal, organismic-environmental transactions explain both typical as well as atypical developmental conditions such as autism.

The structural-behavioral model of development also focuses on interactions between the organism and the environment, each with its various dimensions (Horowitz, 1987). The organism has a physiological or organic integrity dimension that varies on a continuum from relatively unimpaired to relatively impaired. For example, a child might have sensory, neurological, medical, or cognitive impairments, each with various levels of severity. The specific impairments and their level of severity affect the physiological integrity dimension.

A second organismic dimension, according to Horowitz (1987), is the degree of vulnerability to adverse environments. On one end of this continuum, the person could be quite effective and efficient using environmental experiences and thereby be relatively resilient to environmental threats. On the other end of this continuum, the individual could be relatively vulnerable because he or she does not profit from environmental experience. This vulnerability dimension is difficult to define and assess; however, it refers to how the organism's biological condition and behavioral repertoire facilitate responsiveness to environmental stim-

uli. According to Horowitz, the organism is the product of the person's genetic endowment and the cumulative impact of experience on the person's biology and environment. These effects are dynamic and domain specific (e.g., motor behavior). Thus, the organism's specific impairments and its vulnerability to environmental threats change over time.

The environmental dimension of the structural-behavioral model of development also is domain specific, dynamic, and on a continuum (Horowitz, 1987). The dimension ranges from environments that are very facilitative to those that are very nonfacilitative of the development of the organism with which they are transacting. For example, a child's environment might be more facilitative of language development but not motor development at a given time; however, at a later date the environment might be more facilitative of motor development and less so for language development. Facilitative environments are those that incorporate the elements that produce effective organic and behavior change, such as trained personnel, effective technology, medical interventions, environmental arrangements, application of behavioral principles, and so forth. The environmental stimuli that will facilitate development of a specific domain (e.g., language development, motor skills) should be derived from relevant empirical evidence.

"Hereditary vulnerabilities establish probabilistic, not deterministic, developmental pathways that evolve in concert with the experiential stressors, or buffers, in the family, the neighborhood, and the school" (Shonkoff & Phillips, 2000, p. 55). The developmental status of an individual at a given time, according to Horowitz (1987), is a function of how the organismic and environmental dimensions interact. Most optimal development, probabilistically, would

occur in individuals with unimpaired physiology, who are resilient to environmental risk factors, when they are interacting with a very facilitative environment. In contrast, the most unfavorable development, probabilistically, would result for individuals with severely impaired physiology, who are vulnerable to environmental insults, when they are interacting with a very nonfacilitative environment. Varying intermediate developmental status would result when the levels of optimality on the organismic and environmental dimensions are within the boundaries of their extremes. The product of the interaction would reflect the specific combinations of the organismic and environmental variables at specific moments in time. Individuals with autism have varying degrees of organic impairment and interact with multiple environments that also vary with respect to their degree of facilitation. Thus, individuals with autism present on a phenotypic continuum or spectrum. Although Horowitz's (1987) structural-behavioral model includes concepts that are difficult to define and measure, the theory directs us to attend to the dynamic transactional nature of organismic and environmental factors when considering human development, including that of children with autism.

Bronfenbrenner (1977) presented a process-person-context-time model as a core component of his bioecological theory of human development. The model incorporates (a) developmental processes or the relations between the individual and the environment; (b) the person's biological, cognitive, emotional, and behavioral repertoires; (c) several levels of ecological context; and (d) various time dimensions. The model postulates that human development occurs as the person actively and reciprocally interacts with the various ecological contexts over time.

With respect to context, Bronfenbrenner (1977, 1979) described hu-

man development in terms of interrelated, nested ecological levels, which can be considered in the environmental context of children with autism. The microsystem, the most basic ecological level, is the immediate temporal and setting context in which the child interacts with the environment. The child with autism operates in various microsystem structures and processes in the home, school, and community. A set of interactive microsystems constitutes a mesosystem. For example, a child with autism has instructional microsystems at home and school that are linked and influence each other bidirectionally. Exosystems have an indirect or secondary influence on the child via their direct impact on other persons who, in turn, interact with the child (e.g., linkages and processes among various contexts in which parents and service providers may interact without the child). The exosystem's formal and informal social contexts affect individuals in the child's micro- and mesosystems and, thereby, indirectly affect the children with autism themselves.

The macrosystem is the superordinate environmental level that subsumes the other ecological levels. This level of ecology affects human development at the societal, ideological, and cultural levels (Lerner, 2005). Societal regulation and cultural values affect children with autism via state and federal legislation, judicial opinions, governmental administrative regulations, health insurance practices, and other societal behavior directed toward children with autism. The influences of the multiple ecological levels impinge on an individual simultaneously and in a transactional manner moment by moment, and do so dynamically. Bronfenbrenner termed the transactions between the organism and the environment over time the *chronosystem*. Bronfenbrenner's theory differentiates and provides elaborate descriptions of the various ecological

levels. His model is helpful in considering the larger social system as an ecological level that should be included in a transactional systems model for autism.

Taken as a whole, the behavioral systems (Novak & Peláez, 2004), structural-behavioral (Horowitz, 1987), and bioecological (Bronfenbrenner, 1977) models of human development, briefly described, have implications for an understanding of the nature of autism and, relatedly, the manner to structure autism services proactively. As stated, human development, including that of persons with autism, occurs in the context of multiple dynamic transactional systems, with both immediate and more remote environments affecting the individual. Autism services should seek to understand, construct, and control the transactions among those environments for the ultimate benefit of persons with autism and their families. The concept of equifinality implies that we should attempt to define and understand the various subgroups of persons with autism whose similar phenotypic expression at a given time was achieved via different transactional pathways and contexts. Diagnostic services, therefore, should be tailored to sort out and understand the various subgroups, including those with comorbid disorders. In addition, we should come to understand the role that different interventions play to account for the various pathways to equifinality.

Given the individual differences among persons with autism spectrum disorders, we should recognize that even those in the same intervention program might have different behavioral outcomes (i.e., multifinality). Nevertheless, autism programs should be adapted to acknowledge and address individual differences to maximize the outcomes for all individuals.

Finally, heterotypic continuity implies that there will be ontological differences for individuals, and our autism programs must change to

accommodate those "moving target" intraindividual differences across the life span. This implies a relative shift in emphasis of intervention programs based on consideration of the developmental status and needs of the individuals across the life span.

Taken as a whole, these behavioral developmental concepts (i.e., equifinality, multifinality, heterotypy) imply that there should be qualitatively different approaches for different subgroups of persons with autism at a given time, and over the life span the approaches should be adjusted either in terms of their quantitative dose or be changed qualitatively.

Transactional Systems Model for Autism

When considering the lives of children with autism and services for them, there are several levels of the environmental ecology that impinge on each other, as well as the child, in a transactional manner. In addition to the children themselves, environmental levels include family members, various service providers and their organizations, the immediate community, universities, the larger society, and its culture. These ecologies provide the context that can be, to varying degrees, either facilitative or nonfacilitative of development. The degree of environmental facilitation can change over time, both qualitatively and quantitatively, as the child interacts with these environments and is changed by them. Likewise, changes in the child might produce changes in the various levels of the social ecology. One or more levels of the ecology might simultaneously affect the child's development and, thereby, produce either independent or interactive effects. Interactions can be reciprocal and either bidirectional or multidirectional.

As suggested by Horowitz (1987), when the various levels of ecology all operate simultaneously in a manner that is facilitative of development,

more optimal outcomes can be obtained within the organismic constraints of the child. This suggests that parents and service providers should work collaboratively in their microsystems to form a mesosystem (Bronfenbrenner, 1979) and implement services in a consistent manner. Service providers should address the many family needs while parents and service providers work collaboratively toward affecting societal behavior and public policy (i.e., Bronfenbrenner's macrosystem). Autism services should attempt to create and coordinate synergistic multidirectional facilitative system effects. For example, parents, professionals, and service organizations could collaborate to exert contingencies on state legislators to appropriate funds for state universities to create professional training programs related to autism. Funding could support hiring faculty, creating curriculum, and scholarships and other forms of financial aid to attract students to these programs. The newly trained personnel who enter the workforce as a result of these transactional efforts eventually will engage in transactions with community professionals, parents, and children with autism.

Likewise, the converse is true. When one or more of the various ecological levels is nonfacilitative, development of the child with autism, as well as the impact on the other levels of the social ecology, may be impeded. Nonfacilitative public policy, for example, might compromise adequate services and thereby impede the transactions between children with autism and their parents. Nonfacilitative levels of the social ecology might thwart reciprocal interactions and be particularly pernicious to children with severe autism with handicapping comorbid disorders, such as mental retardation. Mixed effects on development could occur to the degree that certain environments are facilitative while others are not. Restrictive social policy, for

example, could constrain the otherwise facilitative transactional effects between parents and service providers and the child. The degree of children's impact on the environment, conversely, will be influenced by their degree of organismic and behavioral repertoire constraints, and, transactionally, the degree of impact by the ecological levels will depend on children's level of vulnerability.

In addition to the direct effects that can occur on a child with autism by interaction with the environment, there might be indirect effects as well. Independently of the child, interactions among the various levels of the ecologies themselves can reciprocally and dynamically transform those ecologies and indirectly affect the child (e.g., parents and providers can affect social policy that then affects the child's more immediate environment and the child him- or herself). These exosystems (Bronfenbrenner, 1979) might be transformed transactionally and independently of the child, as well as by interactions with the children themselves in a dynamic and continuous manner over time. A model of effective services for children with autism should identify the relevant levels of the child's ecology and address how those levels can be positively influenced by the autism program created. Each level of environmental ecology should be considered a target for intervention in a comprehensive autism program.

Evidence-Based Practice Models for Autism

The transactional theories of human development cited previously serve as a foundation for a macro-level understanding of the development of children, including those with autism. These theories also lend themselves by extrapolation to autism services at a strategic level; however, strategic concepts must be translated into tactical operations at

the everyday practice level. Research during the past several decades has provided evidence for effective strategies and tactical operations to promote transactions among levels of the social ecology. An expert committee identified the general characteristics of effective interventions for children with autism (National Research Council, 2001). The strategies include initiation into an intervention program as soon as autism is suspected; a minimum of 25 hr per week, year long, of intensive instruction in which the child is actively engaged in learning activities that vary according to the child's chronological age and developmental level; individual and small-group planned instruction in a series of 15- to 20-min time blocks directed at individually determined child goals; a student-to-teacher ratio that does not exceed 2 to 1; parent participation, including parent training; and program modifications based on individual child assessment and program evaluation. Although these recommendations are generalizations about the needs of a heterogeneous class of individuals diagnosed with autism, the recommendations can be tempered by individualization of intervention for all the children on the spectrum.

With respect to specific treatment packages or intervention methods, a U.S. Department of Health and Human Services' Surgeon General's report (1999) concluded that there had been a 30-year history of research in support of the efficacy of applied behavioral methods for children with autism. This body of research evidence also led the New York State Department of Health (1999) to recommend that intervention strategies derived from the applied behavior analysis literature be incorporated in all programs for young children with autism. More recently, Simpson et al. (2005) reviewed the research literature and assigned strength of evidence ratings to various interventions. These authors stated that the

following skills-based interventions and treatments are “scientifically based practices”: applied behavior analysis, discrete-trial training, and pivotal response training.

It should be noted that applied behavior analysis is the broad application of the science of behavior employing many tactics and is not a specific intervention or treatment per se. Discrete-trial training and pivotal response training are both based on behavioral principles and research and are part of the broader field of applied behavior analysis. In addition to these skills-based interventions, Simpson et al. (2005) also identified Learning Experiences: An Alternative Program for Preschoolers and Parents (LEAP), a cognitive intervention, as a scientifically based practice. LEAP is a program mediated by typically developing peers that incorporates the best practices previously cited (National Research Council, 2001). Simpson et al. had classified other autism treatments as promising practice ($n = 13$), limited supporting information for practice ($n = 18$), and not recommended ($n = 2$).

The literature provides support for an autism intervention program that is tactically based on the principles of applied behavior analysis. The program should take advantage of the broad range of knowledge from the conceptual, experimental, and applied behavior analysis literature, and should not be restricted to any single training procedure with which it might be identified by the public (e.g., discrete-trial training, verbal behavior training) or to an intervention package identified with a single advocate. In addition to the research evidence in support of applied behavior analysis interventions for children with autism, there is a substantial body of literature from the discipline demonstrating successful applications to other levels of the social ecology, such as parents, teachers, paraprofessional staff, organizations, and com-

munity (see the *Journal of Applied Behavior Analysis*).

The developmental systems models, transactional systems model, and evidence-based-practice literature lead to the following conclusions regarding autism disorder and autism services.

1. Developmental systems models of human development, as a class, have utility for considering the development of children with autism. All these models, as well as applied behavior analysis, share the view that human development progresses by multiple simultaneous and continuous transactions between the organism and environment, thereby causing both to change reciprocally over time.

2. Typical as well as atypical developmental outcomes can be accommodated by the structural behavioral model’s description of how the organism, with its relative degree of organic impairment and effectiveness in using environmental experience, transacts with the level of environmental facilitation (Horowitz, 1987).

3. Autism programs should assess children’s impairments and the degree to which they effectively and efficiently use environmental experience, and engineer the environments to facilitate development (Horowitz, 1987).

4. Programs should be aware that autism is a spectrum disorder and children might arrive at the same behavioral endpoints via different transactional pathways (i.e., equifinality), they may achieve different behavioral endpoints (i.e., multifinality), and that there will be ontological differences among children (i.e., heterotypic continuity). The implications of these concepts of human development for autism programs are that they should be individualized for children and changed over time as children’s impairments and their effectiveness using environmental experience change.

5. Comprehensive autism programs should engage in strategic planning to determine how to promote transactions among multiple ecological systems, for example, child, family, human service organizations, governmental units, and society at large (Bronfenbrenner, 1977). Interactions among ecological levels should be planned, with projections made regarding how specific direct and indirect transactions might be produced as outcomes to modify the ecosystem. Subsequent to the planning, new services and activities should be initiated by an organization to create strategic transactional impacts that will enhance the organization's mission.

6. At a tactical level, interventions based on the science of applied behavior analysis have demonstrated efficacy and effectiveness, and they should be part of a treatment program for children with autism (e.g., Simpson et al., 2005).

7. Validation of the transactional systems model of human services should attempt to measure bidirectional or multidirectional transactions among the relevant levels of the social ecology, and not merely the typically reported unidirectional impacts.

These conclusions have been integrated and applied to the development of a university-based autism center that also serves as a regional training and service center for a state-wide autism program. The center's components and programs will be described briefly in the context of the seven conclusions previously cited.

Center for Autism Spectrum Disorders (CASD)

The CASD originated in 2000 as a program to provide clinical training to graduate students in the Behavior Analysis and Therapy and Communication Disorders and Sciences Programs in the Rehabilitation Institute at Southern Illinois University. The program was formalized as a University Center in 2003. That year the

center became one of three founding partners in the state-funded The Autism Program, whose function is to provide the strategy and framework for the State of Illinois to address the complex issues involved in diagnosis, treatment, and research for children in Illinois with autism spectrum disorders. CASD is The Autism Program's Southern Illinois Regional Training and Service Center. The Autism Program partially funds CASD, with additional funds generated by fee for service and in-kind contributions by Southern Illinois University (e.g., some faculty salaries, facilities, some commodities).

The developmental systems models, their application to autism, the risk factors associated with autism, the various ecological systems that impinge on the lives of children with autism, and the empirically supported best practices have been integrated to inform the development of the CASD transactional systems model for autism services for young children. Some of the most relevant programs and services of the CASD will be described briefly as they relate to the transactional systems model for autism services. Subsequently, these programmatic components will be integrated into a figure that suggests their dynamic transactional relation over time. Issues regarding validation of the model by program evaluation will be discussed. The transactional systems model described is not dependent on the unique context of CASD. Transactions such as those described potentially can occur in the context of any autism, or more generally, other human service program. The breadth of a program's efforts across multiple ecologies, however, will affect the interactions that are possible and their potential for dynamic transactions. These efforts are, in part, dependent on a program's financial, personnel, and other contexts.

Services Measuring Organismic Impairment and Degree of Environmental Vulnerability

Autism assessment. Parents may initiate contact with CASD regarding a concern that their child might have an autism spectrum disorder. Children are then scheduled for a Level 1 autism screening that includes a case history, a child observation, and a parent interview to determine the likelihood of an autism spectrum disorder based on the *DSM* (2000). Those children who either already have a diagnosis or show symptoms of an autism spectrum disorder during the Level 1 assessment are invited for a Level 2 assessment to confirm the presence of autism. The ADOS (Lord et al., 2000), the ADI-R (LeCouteur et al., 2003) when ADOS results are not definitive, and clinical observation help to identify the presence and level of impairment of an autism spectrum disorder, the child's degree of environmental vulnerability, and the possibility of comorbid impairments. Based on the results of these assessments, referrals are made as appropriate to initiate services between the child and the multiple ecological levels that affect the child. Referrals might be made to CASD programs, early intervention services, school districts, and other medical and human service providers. Direct and indirect transactions can occur among the children, parents, CASD staff, and community service providers. Information obtained from the children and parents permits CASD staff to provide diagnostic information to parents, which, in turn might change the nature of the transactions between parents and their children as well as parents and community service providers.

Assessment for treatment planning. In addition to autism assessment, CASD performs various assessments for treatment planning for children in its intervention programs. These as-

sessments measure the specific nature and level of the child's impairments as well as the degree of vulnerability the child has to the environment. Assessments include stimulus preference, language, social, self-help, and other basic skills (Partington, 2006), as well as challenging behavior (O'Neill et al., 1997). The assessments help to identify more precisely individual children's behavioral skills and deficits that are then considered when designing a facilitative environment to promote therapeutic transactions.

Sibling surveillance and assessment. There is an increased prevalence of autism spectrum and related comorbid disorders for siblings of children already diagnosed with autism. CASD offers surveillance of the siblings of the children whom CASD assesses as well as those in CASD's intervention programs. Based on information provided about siblings on a child's case history during Level 1 autism assessment, parents may be invited to have the sibling formally assessed or are referred to other service providers as appropriate. Inquiries about and informal observations of siblings also might lead to invitations of siblings for autism screening. A goal is to have the child enter facilitative environments as early as possible. Surveillance and assessment are also used to promote parent education about autism, which, in turn, enables parents to observe their children's behavior in a more discriminating manner and interact with them more effectively at home. This program attempts to intervene as early as possible in the developmental process to promote transactions among the children, their parents, and relevant human services.

Services That Affect Transactions Between Children and Service Provider Ecologies

The following CASD intervention services promote direct transactions among the children, parents, and

CASD staff, and have an indirect effect on other levels of the social ecology. The focus, however, is promoting transactions between children and service providers.

Individual therapy sessions. Children typically begin therapy only with individual sessions, which also are scheduled for children during one of the three laboratories described below. An individualized program that specifies goals and detailed instructional methods is designed for each child based on applied behavior analysis. Graduate student staff consider a child's organismic and behavioral limitations (e.g., joint attention), determine motivational strategies (e.g., motivating operations, stimulus preferences), and assess communication modalities. Children are taught to attend during instruction, to tolerate increasing instructional demands, and to engage in basic communication strategies. Additional individual goals might include basic academic, social communication, and self-help skills, as well as goals related to other deficits of autism including challenging behavior. Individual sessions also are used to provide speech therapy. These sessions serve as a model for evidence-based practice and for experiential training for service providers, graduate students, and parents. Throughout the intervention there is continuous assessment of children's limitations, their degree of vulnerability to their current environment, and the level of impairment the children demonstrate. Continuous assessment during individual sessions informs the construction of a more facilitative environment for individual children and their unique limitations and vulnerabilities at all levels of the social ecology.

Laboratory to teach basic skills. This demonstration classroom serves children with autism and possible comorbid disorders (e.g., mental retardation, attention deficit hyperactivity disorder) who have limited

behavioral repertoires and possible challenging behavior (e.g., stereotypy, aggression, and self-injurious behavior). The children's challenging behavior presents obstacles to their profiting from a program whose goal is primarily to promote social interaction with other children. Instruction is largely individual discrete-trial training, with several opportunities throughout the session for learning in naturalistic group activities. Goals are similar to those stated above for individual therapy sessions, with the addition of goals related to shaping social proximity to and tolerance of other children by participation in parallel activities with them.

Laboratory to promote social interaction. Embedded in this model classroom are a number of individual child and group goals targeted at the core autism deficits: communication, socialization, and restrictive-repetitive behavior. Unlike individual sessions, this demonstration classroom promotes social communication skills and tolerance of demands within a naturalistic group context. Children also spend approximately 50% of the time in individual discrete-trial training sessions. Also, this laboratory prepares the child either for preschool classroom instruction or day-care routines. This demonstration classroom affects the social ecology at the family and service provider levels by offering experiential training on the characteristics of autism and best practices in treatment for young children with autism spectrum disorders. A goal is for staff to promote transactions among themselves, children, and parents.

Laboratory to support full inclusion. This model classroom is designed to facilitate the child's placement in the least restrictive, yet most facilitative, school environment, and to support this placement thereafter. The core deficits of autism continue to be targeted so that the student may be successful in a classroom setting and

require fewer and less intensive environmental supports. To prepare the child for school, activities are provided that require attending to instruction within a group and tolerating a number of teaching demands typical of school settings. Teaching self-management, social communication, and play skills (e.g., games, pretend play, and recess activities) are also targeted. In addition, this laboratory's summer program provides support for community participation in a variety of shopping, recreational, restaurant, and other settings outside the home. It provides a model for evidence-based practice and influences several social ecologies. It is a site for experiential training for both education personnel and parents and is a setting to learn which instructional strategies are effective for specific children. As with the laboratory to promote social interaction, improvements in the children's behavior can reinforce the intervention behavior of parents and service providers, thereby establishing reciprocal transactions. In addition, the change in children's behavior that occurs as a result of transactions with CASD staff can affect the transactions between the children and their teachers and classmates. These transactions can then affect the transactions between children and CASD staff. From time to time, these three laboratories will include typically developing children, often the sibling of a child in the program.

Services That Affect Parents and Home Ecologies

The following services provided by CASD are intended to affect transactions between center staff and parents directly and between these two levels of the social ecology and the children indirectly. Home consultation and parent training typically are offered based on parent interest and as needed by the child. The child gener-

ally is in one of the laboratories, has been assessed for treatment planning, has had his or her behavior come under instructional control, has reinforcers identified, and is responding to instruction sufficiently well to permit guidance by the family. Transactions occur among center staff, parents, and children.

Home consultation. Home consultation targets behavior specific to the home environment, such as behavior that occurs around home routines and challenging behavior. Individual child needs are targeted, including child safety, eating concerns, toileting, and communication strategies. These in-home sessions may be used to coordinate services and promote transactions among both CASD and early intervention providers as well as family-hired home-based trainers and family members.

Parent experiential training. This program is designed to provide guided practice within the context of CASD's programs. Parents participate in on-campus training by observing clinician and child interactions, receiving instructions, and observing their child in CASD programs. Parents may be taught and practice teaching basic skills in the CASD laboratories under staff supervision. This training prepares parents to provide additional hours of therapy at home and to understand the basic concepts involved in their child's therapy. Parents are also taught skills to manage problem behavior as it arises either in the home or in the community. From this transactional intervention, changes are made in the parents' behavior, both directly (by education and instruction) and indirectly (by reinforcing feedback as the child responds positively to the parent's behavioral changes). Parent experiential training can directly increase the facilitation of the home environment for the child and indirectly influence the child's behavior, functioning, level of impairment, and degree of vulner-

ability to the home environment. This training also is provided to community service providers, including school personnel.

Case management and parent support. Individual case management is provided to monitor a family continually and to support them as necessary. Parent support is available immediately when a child enters the program and to parents of children who are not in the program. A monthly support group is designed to offer educational information and emotional support by providing a positive social outlet for parents. Monthly meetings are scheduled with guest speakers who focus on topics, such as child safety, toilet training, parenting stress, and individual education plans. These support groups facilitate transactions among different levels of the social ecology, including parents, CASD staff, community professionals, and organizations.

Multidisciplinary professional consultation. Consultation to CASD staff and parents, as well as direct services to children and parents in some cases, is made available by Southern Illinois University faculty in several programs, including dental hygiene, physician assistant, food and nutrition, rehabilitation counseling, psychology, and special education. Parents can be referred for counseling and children for the CASD behavioral-dental and behavioral-medical treatment programs. Consultation is available from university faculty regarding special education law and nutrition concerns. The overarching transactional goal of this program is to have members of the university environment directly influence members of other social ecologies who affect the children indirectly. In turn, the behavior of university professionals whose specialty might not be autism could be affected by their interactions with those levels of the social ecology that are involved with autism.

Services That Affect Community Ecologies

Professional provider case-based consultation. Case-centered consultation serves as an avenue for training service providers on the characteristics of autism and treatment best practices using the child as a case example. This consultation, in turn, influences the ecological system because an increased number of service providers become experienced in identifying the characteristics of autism and incorporating best practice into their services. The primary intent of case-specific consultation is to promote generalized skills by school personnel that can be applied to other students. This activity promotes a sequence of transactions across several levels of the social ecology, with ultimate indirect and direct influences on the child.

School consultation. School consultation is provided for children who either are or have been served in the CASD laboratories and other students with autism spectrum disorders who have not been in CASD programs. This consultation is intended to promote consistent services between the school classroom and CASD. Ultimately, this consultation is provided to support students so that they may receive education in the least restrictive and most facilitative environment. Because the core deficits of autism often inhibit the provision of educational services in the least restrictive environment, communication, social deficits, and challenging behavior are often the focus of school consultation. Case-centered school consultation affects the social ecology because school personnel are trained in the characteristics of autism and effective intervention strategies in the context of specific students. These school personnel are able to provide a more facilitative environment to the individual child with autism, thereby improving that child's functioning

and reinforcing the school personnel's intervention behavior. Furthermore, the children's improved school functioning might generalize to the home or the behavior could be directly trained in the home, thereby enhancing transactions between children and their parents. Training the same skills to children and using similar instructional materials and procedures in the various settings could enhance children's responding to multiple exemplars within the class of physical setting (e.g., school, home). Contact between the school personnel and parents can lead to more consistency of environmental variables across ecological levels, further enhancing stimulus control of the child's behavior.

Lecture-based training. Didactic training is designed to increase knowledge and understanding of autism spectrum disorders as well as evidence-based treatments. Community service providers, parents, students, and others are provided information related to autism. The characteristics of autism are taught to facilitate an understanding of the disorder, early referral, and diagnosis. Best intervention practices also are discussed. This aspect of the CASD program can affect various levels of the social ecology by investing in training key stakeholders. Through both direct and indirect transactions, this training serves to influence the environment in the community, at school, and at home. Increasing the facilitation of these environments thereby indirectly affects the child's functioning.

University student training. Graduate student training is intended to provide didactic and hands-on experience (practicum, internship, research) in transdisciplinary assessment, planning and implementation of individual and group therapies, program evaluation, and research. Under the supervision of faculty, graduate students also have the opportunity to provide school- and

home-based consultation while collaborating with other service providers. Students also help to design instructional materials and participate in parent and professional provider training and didactic presentations. Preprofessional training of graduate students contributes to the social ecology by supplying a trained workforce of service providers in the field of autism spectrum disorders. This trained workforce, in turn, can influence the ecological system at a higher level by public policy initiatives and systems changes and at a lower level by changes in the school and community environments in which the child and family interact. The trained workforce also engages in transactions with parents and children.

Services That Affect the Greater Society Ecology

Hispanic outreach. CASD has employed a Spanish bilingual-bicultural board-certified behavior analyst (BC-BA) to perform outreach to the Spanish-speaking communities in southern Illinois. Spanish-language presentations to parents and service providers are offered. In addition, translation for parents and children can be arranged, as can direct behavioral services in Spanish or English. By influencing services across the cultural groups in our region, the CASD transactional model influences the larger culture, including individuals, organizations, and the public policies associated with that larger culture.

Child find and health fairs. Along with other community services, CASD participates in child find activities to help identify children who should be referred for autism assessment. This helps to identify children's impairments and vulnerability to environmental experience and initiate environmental interventions as early as possible. Child find and health fairs also serve to inform the community about autism and increase awareness

of the disorder at the greater societal level, thereby creating conditions for transactions to occur.

Program evaluation and research. CASD conducts a full range of program evaluation, including needs assessment, process evaluation, and outcome evaluation. In addition, CASD faculty and students engage in research, including externally funded projects, related to autism assessment and intervention. CASD collaborates with other university academic programs and research centers to conduct research related to autism. Through research and program evaluation, the CASD transactional model reaches the highest level of ecological impact—the greater society and public policy.

Multimedia center. CASD employs a cinema-photographer to work with clinical staff to create video productions that are used for parent and professional staff training and community education. In addition, video productions help to educate legislators and influence public opinion about autism and the services needed to treat the disorder. In this way, the video productions serve as tools to affect multiple ecological levels.

Public policy. CASD, both independently and in collaboration with The Autism Program and other state advocacy organizations, works to affect public policy in Illinois related to autism. To the degree that CASD can successfully collaborate with other levels of the ecology to promote favorable social policy, that policy, in turn, can affect children, parents, and providers. Examples of successful collaboration have resulted in the passage of PA 94-0948, which includes BCBA's among professional personnel in special education. This allows school districts to be reimbursed for hiring BCBA's. Currently, there is a bill (HB 1362) before the General Assembly that would provide financial incentives for school personnel to meet the educational and training requirements to sit for

the BCBA exam. CASD also is working toward the inclusion of BCBA's as early intervention service providers.

Community relations. CASD disseminates information about autism and CASD services to the media to help to educate the public and build political support. These efforts are intended to have an indirect transactional impact on children with autism and their families via various levels of the social ecology.

Toward a Validation of a Transactional Systems Model of Autism Services

A transactional systems model of autism services, including the child, family, service providers, university, and society as exemplars of the social ecology, is shown in Figure 1. The bidirectional solid arrows among the different levels of ecology within a given time frame indicate contemporaneous transactions. The figure shows each level of social ecology transacting with each other level. In reality, the transactions might be more limited. The unidirectional dashed arrows between the same levels of social ecology over time indicate dynamic transformation of those levels. Program outcomes are used for formative evaluation to improve the program directed at the level of the ecology from which outcomes were measured. To the degree that the levels of social ecology change in the direction predicted by the theory, there is an "outcome pattern match," which denotes correspondence between the theoretical prediction and actual outcomes of a program (Trochim, 1985). Such correspondence supports the construct validity of the program. Lack of correspondence suggests questioning the construct, the program design, and fidelity of program implementation.

Validation of program theory by outcome evaluations can be very

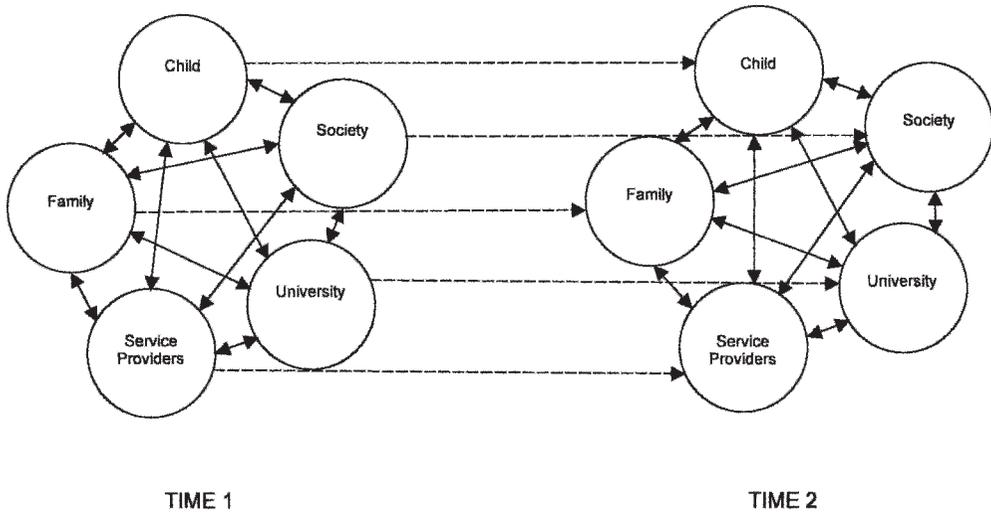


Figure 1. A transactional systems model of autism services.

complex in a transactional systems model. Most of the autism research and program evaluation literature shows unidirectional influence between two levels of the social ecology (e.g., an intervention delivered by a service provider that affects children with autism). A transactional systems model, in contrast, can involve multiple levels of the social ecology and multiple directions of influence, with transactions that occur both simultaneously and dynamically. The implication of a transactional model for program evaluation is that it should involve multiple multidirectional measures over time of the various ecological levels that are involved in the transaction.

The evaluation challenge is to determine the operative levels of the social ecology for a particular program, the directions of influence of these levels, and how that influence occurs over time. For an intervention program that focuses on teaching parents to be trainers of their children, for example, program evaluation initially should involve various bidirectional outcome measures of both the parents and their trainers. How are the parents changed by the

trainers, and, in turn, how are the trainers changed by the parents?

Subsequently, the program evaluation should include outcome measures of the reciprocal transactions between parents and their children with autism. As a result of training by their parents, children's performance might improve on various outcome measures as a function of that training (e.g., skill acquisition, greater community participation). As a result of the children's improvement, the parents' performance might be enhanced on various behavioral, attitudinal, and physiological measures (e.g., parents' child-training behavior, stress reduction). Finally, the parent trainers (i.e., those who trained the parents) might be changed indirectly by the change produced by the parents' direct transactions with their children. For example, the instructional behavior of the trainers might be reinforced. To the degree that formative program evaluation takes on these multiple, multidirectional, dynamic measures that assess the transactional ecological nature of the service program, the model can be either validated or modified based on the data.

There are major challenges with performing objective behavioral measurement of transactional outcomes and drawing inferences from the data. The challenges include identifying the levels of social ecology that are affected, designing valid and reliable measurement, making inferences from outcome snapshots taken at a point in time when reality is dynamic, making inferences about a functional relation when threats to internal validity are not controlled (e.g., history, maturation), and making inferences about a program's construct validity, which is dependent on interventions and outcome measures being accurate with respect to the program theory (e.g., interaction of interventions might threaten the program's construct validity). Given this difficulty in conducting controlled experimental research in dynamic uncontrolled natural environments, an alternative suggested in the literature is modeling contextual effects in longitudinal studies using statistical approaches (e.g., Little, Bovaird, & Card, 2007; van Montfort, Oud, & Satorra, 2007).

Considering the difficulty of objective transactional systems measurement, CASD is piloting subjective rating scales as initial indirect transactional program evaluation measures. There is a Clinical Instructor Questionnaire that asks instructors to rate their level of agreement on a 5-point Likert-type scale for 21 items. Items include: "I saw the clients improve as the graduate students improved as clinicians"; "When parents tell me about the success they have experienced because of my recommendations, I want to help other families by giving them recommendations." There are too few pilot data at this time to report meaningful results for this measure. A second questionnaire with a similar transactional ecological analysis purpose and instrument construction was developed for graduate students, who are the primary service providers at

CASD. Items include: "I saw my client improve as I improved as a clinician" ($N = 20$, $M = 4.40$; $SD = 0.82$); "The CASD staff made recommendations during my therapy sessions that improved my sessions and child outcomes" ($N = 20$, $M = 4.45$; $SD = 0.69$). Both of these questions measure graduate student subjective report regarding reciprocal interactions among and effects on different levels of the social ecology.

To progress from such subjective to more objective measurement of transactions, for purposes of demonstration one could focus on situations in which there is the most control (e.g., between therapist and a child who receives no other training; or parent trainer, parent, and child for whom there is no other programmed training). Child measures could include improvement on standard behavioral measures of skill acquisition, maintenance, fluency, and generalization correlated with training trials. Therapist measures could include improvement on instructional techniques correlated with training trials (e.g., use of descriptive praise, implementing the components of discrete-trial training). CASD has various rating forms to evaluate graduate students on their instructional performance (e.g., discrete-trial training). The transactional assumption is that improvement of the child's behavior is a result of effective instruction by the therapist, and, in turn, the child's behavioral improvement reinforces the therapist's training behavior. Other sources of influence on child and therapist behavior would have to be controlled to make an inference of a functional relation, and this is difficult to accomplish when families live in natural uncontrolled community environments.

Conclusions

The foundational conceptualization underlying the CASD program

is developmental systems theory, which bases human development on dynamic transactions between the child and multiple levels of the social ecology. The transactional systems model of autism services can be considered to be an extrapolation from developmental systems theory. The transactional systems model incorporates an understanding of the organismic impairments of autism disorder, various environmental or systems levels, relevant empirical research evidence, consensual best practices, and program evaluation outcome data. Given this understanding, a road map for multiple interrelated interventions across the various ecological levels (e.g., family, service providers, community) could be constructed to promote the development of children with autism in a transactional manner. The autism services described are not unique to CASD, but they have been strategically planned to promote transactional systems impacts. Likewise, the transactional systems model is not restricted to autism services. The model also will provide a comfortable home to other human services, with tailoring to their unique contexts. A challenge is to continue to develop the program evaluation methodology to measure as objectively as possible the reciprocal dynamic effects of the various environmental levels.

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